MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Electrical Engineering and Computer Science

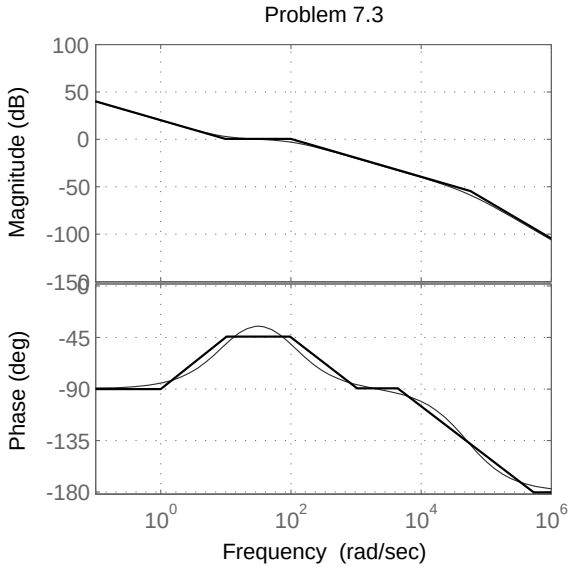
6.003: Signals and Systems — Spring 2004

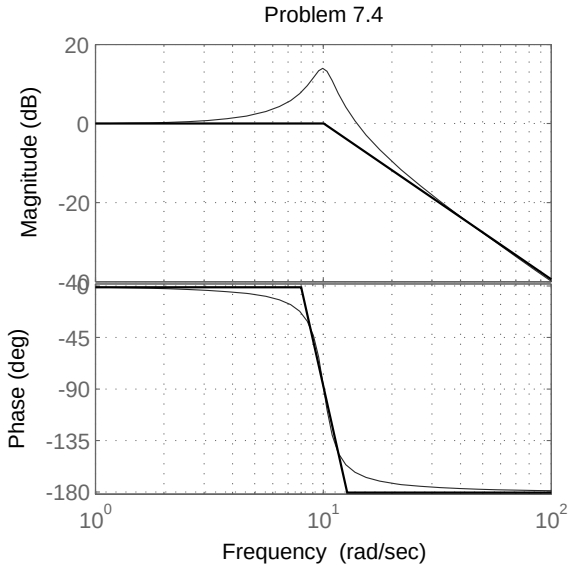
Tutorial 7 Solutions

Tuesday, March 30, 2004

Problem 7.1
(a) $x(t-1)$, delay by 1.
(b) $x(t+0.5)$, advance by 0.5.
(c) $\cos(t+1.01)+\cos[2(t+1.04)]$, advance by 1 with a little distortion.
(d) $-x(t-1)$, negate and delay by 1.
(e) $e^j x(t-1)$, scale by e^j and delay by 1 (note that $h(t)$ is not real).
(f) $x(t-1)$, delay by 1 (note that in general the system will severely distort an input).

Problem 7.2
(a) The envelope is a sinc, and 2000 periods of the sinusoid fit under the center lobe of the sinc.
(b) $x(t-1)$, the entire signal picks up a group delay of 1.
(c) $v(t-\tau)\cos[1000t-\phi]$, the envelope picks up a group delay of τ, while the sinusoid picks up a phase delay of ϕ radians.





Problem 7.5

(a) 1: H_4; 2: H_1 and H_2; 3: H_5; 4: H_3.

(b) See below.

(c) Yes. $H_7(j\omega) = -H_1(j\omega)$ or $-H_2(j\omega)$ or $\frac{j\omega+100}{10(j\omega-10)}$ or $-\frac{j\omega+100}{10(j\omega-10)}$.

(d) See below.